

R E M A R K S

Reconsideration of this application, as amended, is respectfully requested.

THE CLAIMS

Independent claims 1 and 10 have been amended to clarify that the photo-sensor comprises a four-divided photodetector light receiving surface, as supported by the disclosure in the specification at, for example, pages 21-23 (in particular, see page 21, lines 3-15), and by the disclosure in, for example, Figs. 8 and 9.

Claim 3 has been amended to depend from claim 6.

Claim 4 has been amended to incorporate the subject matter of claim 3 and to depend from claim 1 (instead of from claim 3).

Claim 5 has been amended to make some minor clarifying amendments and to be rewritten in independent form.

Claim 6 has been amended to be rewritten in independent form.

Claim 7 has been amended to better accord with its parent claim 6 and with the disclosure in the specification.

Claim 9 has been amended to make a minor clarifying amendment.

New independent claim 11 has been added based on the subject matter of claims 1, 3 and 4 and to recite the feature of the

present invention whereby the light guiding means is adapted to split the light beam transmitted through at least one of the optical-path switching elements using a hologram and then to guide a beam split from the light beam to the photo-sensor, as supported by the disclosure in the specification at, for example, pages 43-45 and Fig. 14.

New independent claim 12 has been added based on the subject matter of claims 1, 3 and 4 and to recite the features of the present invention whereby the optical switch comprises a lens through which the light beam transmitted through at least one of the optical-path switching elements is converged onto the output optical fiber, and whereby the light guiding means is adapted to split the light beam transmitted through at least one of the optical-path switching elements using a beam splitter and then to guide a beam split from the light beam to the photo-sensor, and wherein the beam splitter is provided in the lens, as supported by the disclosure in the specification at, for example, pages 43-45 and Fig. 14.

No new matter has been added, and it is respectfully requested that the amendments be approved and entered.

CLAIM FEE

The application was originally filed with 10 claims of which 2 were independent. The application now contains 12

claims, of which 6 are independent. Accordingly, a claim fee in the amount of \$600.00 for the addition of 3 extra independent claims is submitted herewith. In addition, authorization is hereby given to charge any additional fees which may be determined to be required to Account No. 06-1378.

THE PRIOR ART REJECTION

Claims 1, 3, 4, 6 and 10 were rejected under 35 USC 102 as being anticipated by USP 6,337,760 ("Huibers et al"), and claims 2, 5 and 7-9 were rejected under 35 USC 103 as being obvious in view of the combination of Huibers et al with one or more of US 2003/0053232 ("Dalziel"), US 2002/0159685 ("Cormack"), USP 6,721,474 ("Wang et al") and USP 3,885,143 ("Ishii"). These rejections, however, are respectfully traversed with respect to the claims as set forth hereinabove.

Re: Independent Claims 1 and 10

According to the present invention as recited in amended independent claim 1, an optical switch is provided which comprises optical-path switching elements for switching one optical path to another optical path to allow one light beam for optical communication emitted from one of at least one input optical fiber used for inputting beams, to be incident on one of at least one output optical fiber from which beams are outputted.

In addition, the optical switch includes a photo-sensor which comprises a four-divided photodetector light receiving surface, light guiding means to guide the beam to the photo-sensor, and control means which controls an angle of each of the optical-path switching elements based on a detection signal obtained through the photo-sensor.

In a similar manner, amended independent claim 10 recites an optical switch comprising optical-path switching elements for switching at least one optical path to another optical path to allow one light beam for optical communication emitted from one of at least one input optical fiber used for inputting beams, to be incident on one of at least one output optical fiber from which beams are outputted. As recited in amended independent claim 1, the optical switch comprises a photo-sensor which comprises a four-divided photodetector light receiving surface, light guiding means to guide the beam to the photo-sensor, and control means which adjusts an angle of each of the optical-path switching elements based on a detection signal obtained through the photo-sensor to adjust at least one of a relative position and an angle of the beam.

As recognized by the Examiner, Huibers et al discloses an input fiber 606 and an output fiber 614, and micromirror arrays 602 and 604 which reflect the beam 608 between the input and output fibers. See Fig. 17. As also recognized by the Examiner,

Huibers et al discloses that beam 608 is incident on "conventional beam splitter 616" to be split into a beam 608a and a beam 608b. According to Huibers et al, the beam 608b is incident on a "conventional photodetector array (e.g., charge coupled device (CCD))" which detects the position of the beam 608b.

Although, as recognized by the Examiner, Huibers et al discloses detecting a light beam split by a beam splitter using a CCD 618, and Huibers et al discloses other embodiments of photodetectors, such as photodetector array 638 in Fig. 18 and the ring of photodetectors 660 in Fig. 10, Huibers et al does not disclose, teach or suggest a photo-sensor which comprises a four-divided photodetector light receiving surface, as according to the present invention as recited in amended independent claims 1 and 10.

With this structure of the claimed present invention, it is possible to easily perform detection of the position in two directions with high accuracy, as compared with the structure (such as that disclosed by Huibers et al) in which a CCD is provided as the photo-sensor.

Dalziel, moreover, has merely been cited with respect to claim 2 as disclosing a galvanometer mirror.

Accordingly, it is respectfully submitted that the present invention as recited in amended independent claims 1 and 10, and

claims 2 and 4 depending from claim 1, clearly patentably distinguish over Huibers et al and Dalziel, taken singly or in combination, under 35 USC 103.

Re: Independent Claim 5

According to the present invention as recited in amended independent claim 5, an optical switch is provided which comprises optical-path switching elements for switching one optical path to another optical path to allow one light beam for optical communication emitted from one of at least one input optical fiber used for inputting beams, to be incident on one of at least one output optical fiber from which beams are outputted.

According to claim 5, moreover, the optical switch comprises light guiding means for guiding a light beam transmitted through at least one of the optical-path switching elements, wherein the light guiding means comprises a base having a hole through which the light beam being transmitted through at least one of the optical-path switching elements passes. In addition, according to claim 5, a photo-sensor is provided which comprises a plurality of photo-sensor sections which are disposed around the hole in the base.

Still further, according to the present invention as recited in claim 5, control means is provided which controls an angle of

each of the optical-path switching elements based on a detection signal obtained through the photo-sensor.

The Examiner has cited Cormack for the disclosure of light receiving elements disposed around a hole as previously recited in claim 5. The Examiner asserts that the optical fibers 146 disclosed by Cormack correspond to the light receiving elements recited in previously presented claim 5.

According to amended independent claim 5, however, the light guiding means comprises a base having a hole through which the light beam being transmitted through at least one of the optical-path switching elements passes, and a photo-sensor is provided which comprises a plurality of photo-sensor sections which are disposed around the hole in the base.

It is respectfully submitted that Cormack clearly does not disclose a plurality of photo-sensor sections disposed around a hole in a base. Indeed, Cormack merely discloses optical fibers as light receiving members. However, according to the present invention as recited in amended claim 5, the control means controls an angle of each of the optical-path switching elements based on a detection signal obtained through the photo-sensor. Cormack, by contrast, does not disclose, teach or suggest that the fibers 146 are photo-sensor sections or using outputs of the fibers 146 to perform angle-control of optical-path switching elements. Accordingly, it is respectfully submitted that Cormack

clearly does not disclose, teach or suggest a photo-sensor which comprises a plurality of photo-sensor sections which are disposed around the hole in the base (of the light guiding means).

As recognized by the Examiner, Huibers et al also does not disclose, teach or suggest the features of the present invention as recited in claim 5.

Accordingly, it is respectfully submitted that amended independent claim 5 clearly patentably distinguishes over Huibers et al and Cormack, even if taken in combination, under 35 USC 102 as well as under 35 USC 103.

Re: Independent Claim 6

According to the present invention as recited in amended independent claim 6, an optical switch comprises optical-path switching elements for switching one optical path to another optical path to allow one light beam for optical communication emitted from one of at least one input optical fiber used for inputting beams, to be incident on one of at least one output optical fiber from which beams are outputted. The optical switch further comprises a photo-sensor and light guiding means to guide the beam to the photo-sensor. And control means controls an angle of each of the optical-path switching elements based on a detection signal obtained through the photo-sensor.

Significantly, according to the present invention as recited in claim 6, the light guiding means is adapted to partially split a light beam transmitted through the output optical fiber and to allow the photo-sensor to receive a beam split from the light beam.

That is, according to the present invention as recited in claim 6, the beam that is partially split by the light guiding means and then received by the photo-sensor has been transmitted through the output optical fiber. See, for example, Fig. 15 of the present application, which shows an example of the structure of the present invention as recited in claim 6. In Fig. 15, the beam transmitted through the output optical fiber 17 is split by the photocoupler 135, and the sensor fiber 137 guides a part of the split beam to the photo-sensor 11C, while the other part of the beam proceeds to the communication fiber 160.

Although the Examiner has cited Huibers et al with respect to claim 6, it is respectfully submitted that Huibers et al clearly does not disclose, teach or suggest splitting a light beam after the light beam is received and transmitted through by the output optical fiber.

Indeed, Huibers et al clearly discloses that the beam 608 is split by the beam splitter 616 before the beam 608 reaches the output optical fiber 614.

Accordingly, it is respectfully submitted that Huibers et al clearly does not disclose, teach or suggest the features of the present invention as recited in amended independent claim 6 whereby the light guiding means is adapted to partially split a light beam transmitted through the output optical fiber and to allow the photo-sensor to receive a beam split from the light beam.

Wang et al and Ishii, moreover, have merely been cited with respect to claims 7 and 9 and also do not disclose, teach or suggest the features of the present invention as recited in amended independent claim 6.

Accordingly, it is respectfully submitted that amended independent claim 6 and claims 3 and 7-9 depending therefrom clearly patentably distinguish over Huibers et al, Wang et al and Ishii, taken singly or in any combination, under 35 USC 102 as well as under 35 USC 103.

Re: Independent Claims 11 and 12

According to each of new independent claims 11 and 12, an optical switch is provided which comprises optical-path switching elements for switching one optical path to another optical path to allow one light beam for optical communication emitted from one of at least one input optical fiber used for inputting beams,

to be incident on one of at least one output optical fiber from which beams are outputted. The optical switch further comprises a photo-sensor and light guiding means for guiding a light beam transmitted through at least one of the optical-path switching elements to the photo-sensor. And as recited in claims 11 and 12, control means controls an angle of each of the optical-path switching elements based on a detection signal obtained through the photo-sensor.

According to new independent claim 11, moreover, the light guiding means is adapted to split the light beam transmitted through at least one of the optical-path switching elements using a hologram and then to guide a beam split from the light beam to the photo-sensor.

According to new independent claim 12, the optical switch further comprises a lens through which the light beam transmitted through at least one of the optical-path switching elements is converged onto the output optical fiber, and the light guiding means is adapted to split the light beam transmitted through at least one of the optical-path switching elements using a beam splitter and then to guide a beam split from the light beam to the photo-sensor, wherein the beam splitter is provided in the lens.

It is respectfully submitted that Huibers et al does not disclose, teach or suggest light guiding means that splits a

light beam using a hologram as recited in new independent claim 11, and it is respectfully submitted that Huibers et al clearly does not disclose, teach or suggest light guiding means that splits a light beam using a beam splitter provided in the lens through which the light beam transmitted through at least one of the optical-path switching elements is converged onto the output optical fiber as recited in new independent claim 12.

Indeed, Huibers et al merely discloses a "conventional beam splitter 616" provided as shown in Fig. 17.

It is respectfully submitted, moreover, that none of the other prior art of record discloses, teaches or suggests the features of the present invention as recited in new independent claims 11 and 12.

Accordingly, it is respectfully submitted that new independent claims 11 and 12 also clearly patentably distinguish over all of the cited references, taken singly or in combination, under 35 USC 102 as well as under 35 USC 103.

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In view of the foregoing, entry of this Amendment, allowance of the claims and the passing of this application to issue are respectfully solicited.

If the Examiner has any comments, questions, objections or recommendations, the Examiner is invited to telephone the undersigned for prompt action.

Respectfully submitted,

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